International Civil Aviation Organization

**WORKING PAPER**

# CONFERENCE ON AVIATION AND ALTERNATIVE FUELS

**Rio de Janeiro, Brazil, 16 to 18 November 2009**

**Agenda Item 4: Production and infrastructure**

## USING COST BENEFIT ANALYSIS FOR ALTERNATIVE FUEL INVESTMENTS

(Presented by the Secretariat)

**SUMMARY**

Sustainable alternative fuels for aircraft have the potential to offer significant environmental benefits, but only if they are available in sufficient quantities. In order for these fuels to become a significant component of the future aviation fuel supply, they must be economically and efficiently produced.

Cost benefit analysis (CBA) is a technique for evaluating the costs and benefits of a project, comparing them in common terms, usually economic, and evaluating them at their present value. The variety of potential alternative fuel feedstocks and production processes, and the complexities of quantifying the benefits of GHG mitigation, suggest the need for an aviation-specific methodology. A globally recognized tool will assist with prioritizing the investments needed to commercialize the production of sustainable alternative fuels for aircraft.

The conference is invited to approve the conclusions in paragraph 4 and the recommendation in paragraph 5.

## 1. INTRODUCTION

1.1 As discussed in CAAF/09-WP/03, sustainable alternative fuels for aircraft are a key element of an overall strategy for offsetting the increase in GHG emissions associated with the projected growth of international aviation. It is essential that these fuels not only serve to reduce GHG emissions compared to conventional jet fuel, but that they are also economically and efficiently produced in order to be cost competitive with current fuels.

1.2 There is a wide range of feedstocks and production pathways that are currently being considered for producing sustainable alternative fuels for aircraft. To deliver these fuels to market, they must be assessed through research and development, then be qualified through a wide range of testing. Pilot scale facilities are needed to confirm design parameters, and finally, commercial scale production plants must be constructed with all associated equipment and facilities needed to transport the fuel to airports. This process will require national and government-backed infrastructure investments in sustainable alternative fuels for aircraft associated with pilot plants and possible full-scale production facilities. It is important that projects are analyzed in a systematic way specific to alternative fuel production to account for all costs and benefits, and appropriately quantify the uncertainty in the results, to ensure these investments are efficiently applied and benefits are maximized

## 2. COST BENEFIT ANALYSIS

2.1 Cost benefit analysis (CBA) is a technique that facilitates the evaluation of the merit of a project on a financial basis, even if the project's anticipated costs or benefits are not typically expressed in monetary terms. It is appropriate for assessing the value of very large private and public sector projects. CBA attempts to put all relevant costs and benefits on a common basis, which allows for the comparison of competing projects on a common scale, weighing the total expected costs against the total expected benefits. This allows the decision maker to choose the best or most profitable option, or to prioritize projects competing for resources.

2.2 For projects such as those involved in producing sustainable alternative fuels for aircraft, it is essential that both direct, and indirect costs and benefits are accounted for. This is especially important for projects intended to mitigate a global challenge such as climate change. Indirect costs and benefits specific to alternative fuel production and use may have effects far from the actual project, both geographically and in time. As described in CAAF/09-WP/04, direct and indirect land use changes may result from the production of sustainable alternative fuels and the effects of these changes on the climate may not be realised for years or decades to come. Even with an expedited development program, it will be many years before these fuels replace a significant fraction of the worldwide consumption of conventional jet fuel.

2.3 When the effects of market based measures are included in the assessment, CBA enables the costs of the fuel selected for aircraft to be put into context with the costs of offsetting the resulting GHG emissions. As an example, a sustainable alternative fuel for aircraft may have a higher direct cost than conventional jet fuel, but if the lifecycle GHG emissions for the alternative fuel are sufficiently lower than the conventional fuel, the reduced cost of offsetting the emissions (an indirect cost) may in fact make the total cost of using the alternative fuel lower than the costs involved in the use of conventional fuel.

2.4 Costs and benefits are commonly expressed in monetary terms to facilitate comparison with the level of expenditure in the programme. When money is the basis for comparison, it is appropriate to adjust for the time value of money. This puts the flow of costs and benefits in context with regard to their "present value." A discount rate is used to adjust costs and benefits to account for the fact that they are realized over time. This allows for significant project factors to be presented at their current value, and the overall project's costs and benefits to be compared equitably.

2.5 The accuracy of the outcome of a cost benefit analysis depends on how accurately costs and benefits have been estimated. Translating costs and benefits into monetary terms, especially those external to the project, and applying an appropriate discount rate can be very complex and therefore, should reflect relationships that have been accepted by aviation stakeholders, wherever possible.

2.6 The baseline period against which project costs and benefits should be compared is the baseline used to quantify the mitigation goal. Recent projections of future emissions have used 2005 or 2006 as the base evaluation period. The appropriate baseline period to use for assessing sustainable alternative fuels for aircraft will likely be decided at COP15. Similarly, the evaluation period to use for an analysis will depend on the term for which goals are established. Mid-term (to 2020) and long-term (to 2050) will likely be the evaluation periods.

2.7 Quantifying costs, benefits, and uncertainty is especially complex and will involve a wide range of assumptions which specifically reflect the external costs of aviation and the benefits that result from the mitigation of aviation's GHG emissions. To be accepted, all data, models, and assumptions should be rigorously evaluated for an aviation application and should be clearly and explicitly identified. For many analyses, the results may be highly dependent on data inputs and assumptions and the transparency of inputs and project methodology will be essential. It will also be important to clearly describe the results of the analysis and explain the basis for the choices that are made.

2.8 Essentially, CBA is a framework methodology for guiding project economic assessment; however it is not possible to create an approach that addresses all possible situations and which covers all potential factors that may be important when analyzing a specific project. Professional judgement is always required for producing investment-grade analyses. For projects related to the role of aviation and its contribution to climate change, a systematic methodology that is tailored to sustainable alternative fuel production will be needed to ensure projects are fairly assessed and investments are made most effectively.

## 3. **CNS/ATM EXAMPLE**

3.1 The investment by a State in a Communication, Navigation, and Surveillance / Air Traffic Management (CNS/ATM) system is an aviation-specific example of a significant cost that must be weighed against benefits that can be challenging to quantify in monetary terms. The tenth ICAO Air Navigation Conference (Montréal, 1991) recommended in this case that States perform their own cost-benefit analyses to determine how they would be affected by new CNS/ATM systems, and that ICAO provide States with assistance in carrying out those analyses.

3.2 ICAO responded by preparing Circular 257, "Economics of Satellite-Based Air Navigation Services." In conjunction with the circular, a series of spreadsheet templates to assist with carrying out the analyses described were also provided.

3.3 The globally harmonized guidance for CBA, as it relates to CNS/ATM systems in Circular 257, allows for the comparability of results across States and a better global assessment of the costs and benefits of deploying those systems. However, it must be recognized that a similarly harmonized CBA methodology specifically targeted at sustainable alternative fuels for aircraft is not available at present. Nonetheless, it is possible to collect best practices for CBA and compile a lessons- learned document that could have similar advantages.

## 4. CONCLUSIONS

4.1 The conference is invited to:

a) acknowledge that cost benefit analysis is an appropriate methodology for effectively guiding investments into the development and production of sustainable alternative fuels for aircraft; and

b) conclude that best practices for CBA methodology that can be tailored to sustainable alternative fuel production, using assumptions and input data that specifically reflect the external costs of aviation and the complex benefits that result from mitigating aviation's GHG emissions, can ensure that projects are fairly assessed and investments are made most effectively.

## 5. RECOMMENDATION

5.1 The conference is invited to recommend that:

a) ICAO facilitate the dissemination of best practices for cost benefit analysis which are appropriate for evaluating sustainable alternative fuels for aircraft.

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